Potential insect vectors of the black stain root disease pathogen on Southern Vancouver Island

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ABSTRACT

Three species of beetles suspected of vectoring the black stain root disease pathogen (*Leptographium wageneri)* were found at two locations on Vancouver Island, British Columbia. The most commonly trapped specie was *Hylastes nigrinus* (Scolytidae) (691) followed by *Steremnius carinatus* (Curculionidae) (64) and *Pissodes fasciatus* (Curculionidae) (31). These insects may be vectors of the fungus that induces black stain root disease but confirmatory studies are needed. Douglas-fir resin at 1% or 10% in 95% ethanol attracted the most insects, whereas 95% ethanol or resin alone attracted the fewest. Pitfall traps captured significantly more of all three species than window traps, and were easier to maintain.

INTRODUCTION

Black stain root disease of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) caused by the fungus *Leptographium wageneri* var. *pseudotsugae* Harrington & Cobb, is a serious problem in the western U.S.A.(Cobb and Platt 1967; Harrington et al. 1983). The disease also causes pockets of mortality on Vancouver Island and the adjacent coastal mainland of British Columbia, although the total regional damage so far appears low. The fungus spreads by root-to-root contacts (Hessburg and Hansen 1986) and is vectored by a root-feeding beetle (*Hylastes nigrinus* Mann.) and weevils (*Steremnius carinatus* (Boh.), and *Pissodes fasciatus* (LeC.)) that attack stressed trees (Hansen et al. 1988).

Recent studies on resistance and mortality rates of black stain root disease, raised questions as to the occurrence of vectors at study sites on Vancouver Island (Jacobi, unpublished data). *Steremnius carinatus* and *Pseudohylesinus nebulosus* LeConte were found previously in black stain affected stands on the Island but the pathogen was not found on these insects (Morrison and Hunt 1988). No previous record appears to exist of *Pissodes* or *Hylastes* activity in areas affected by black stain.

Thus the two objectives of this study were to determine how most efficiently to attract and trap these insect species and to determine if potential vectors of the pathogen were present at two black stain disease centers on Vancouver Island.

MATERIALS AND METHODS

The two study plots were near Sooke and Port Renfrew B.C. on southern Vancouver Island. The Sooke plot was in a naturally regenerated Douglas-fir stand, 18 yr old, 13 km north of route 14 and 0.2 km west of the Butler Main line. The Port Renfrew plot was in a 21 yr old planted Douglas-fir provenance trial about 7 km east of Port Renfrew off the Lens Creek main line. Both plots were active centers of black stain root disease with trees showing a range of symptoms from near healthy to dead. Black stains, diagnostic of black stain root disease, were found on roots and root collar of declining trees.

Twelve insect traps were placed at each plot from April to June 1990 to determine which potential insect vectors were present. Four traps, located around an affected tree, were placed at three sites within each plot. Three traps were nondirectional window types, consisting of two 30 × 30 cm clear plastic "windows", a collecting funnel and a jar containing 10% antifreeze solution. Plastic tops were placed on the traps to exclude rain. The traps were suspended 0.8 m above the ground from posts driven into the ground at an angle.

Table 1

Occurrence of Potential Vectors of Black Stain Root Disease at Sooke and Port Renfrew, B.C. 1990.

		Collection Date							
Insect[a]/Trap	**Location[b]**	**4/18**	**4/28**	**5/10**	**5/24**	**6/5**	**6/21**	**Total**	**Total[c]**
100% Resin-Window									
Hylastes	S	—	1	21	0	0	4	26	76 c
	P	0	0	25	0	4	21	50	
Pissodes	S	—	0	3	0	0	0	3	4 b
	P	0	0	0	0	0	1	1	
Steremnius	S	0	0	0	0	0	0	0	0 b
	P	0	0	0	0	0	0	0	
1% Resin-Window									
Hylastes	S	—	32	20	0	11	46	109	220 b
	P	8	0	38	2	6	57	111	
Pissodes	S	—	0	0	0	0	0	0	5 b
	P	2	0	3	0	0	0	5	
Steremnius	S	—	1	0	0	0	0	1	1 b
	P	0	0	0	0	0	0	0	
95% Ethanol-Window									
Hylastes	S	—	3	4	0	2	4	13	40 d
	P	0	0	8	0	2	17	27	
Pissodes	S	—	0	1	0	0	0	1	4 b
	P	1	0	1	1	0	0	3	
Steremnius	S	—	0	0	0	0	0	0	0 b
	P	0	0	0	0	0	0	0	
10% Resin-Pit Fall									
Hylastes	S	—	0	37	18	30	85	170	375 a
	P	9	5	46	47	32	66	205	
Pissodes	S	—	0	10	0	0	3	13	18 a
	P	0	0	4	1	0	0	5	
Steremnius	S	—	0	4	3	1	1	9	63 a
	P	18	4	10	11	5	6	54	

[a]Insects are *Hylastes nigrinus*, *Pissodes fasciatus* and *Steremnius carinatus*. Baits were 100% Douglas-fir resin or resin dissolved in 95% ethanol. Insect counts are totals from 3 traps.
[b]Locations are (S) Sooke and (P) Port Renfrew on southern Vancouver Island, B.C.
[c]Totals of insect counts over both locations. Counts by insect type followed by the same letter are not significantly different ($P > 0.01$) based on Chi-square tests.

Baits for the three window traps consisted of 95% ethanol, 1% Douglas-fir resin in 95% ethanol, or 100% resin. The resin was collected previously from a cut stump and used because turpentine is a good attractant (Payne et al. 1978). One pitfall trap was placed at each of the three sites. The trap was a plastic Multipher(R) trap (Biocontrol Services, Ste Foy, Quebec, Canada) placed in the ground with a jar filled with 10% antifreeze inside to collect the insects. Bait for the pitfall traps was 10% resin in 95% ethanol. The baits were placed in 35 mm plastic film canisters with four 2 mm holes in each lid. Elution rates of the baits were 20-30 ml of 95% ethanol per 14 days. Baits were suspended half way down the "windows" and on the under side of the pit trap lids.

Collections were made every 10-14 days and the numbers of *Hylastes*, *Pissodes* and *Steremnius* were recorded. Insects were identified by H. A. Moeck and R. Duncan, entomologists at the Pacific Forestry Centre, Victoria B.C.. A Chi-square analysis tested for uniform distribution of insect counts by species collected among four baits in both trap types and among three bait types in window traps.

RESULTS AND DISCUSSION

Three insect species suspected of vectoring *Leptographium wageneri* were found at both locations (Table 1). The most commonly trapped insect species was *Hylastes nigrinus* (691) whereas *Steremnius carinatus* (64) and *Pissodes fasciatus* (31)were found less often. Only seven *Pseudohylesinus nebulosus* were trapped in window traps and one in a pitfall trap. Morrison and Hunt (1988) captured *P. nebulosus* in trap log sections which may be more attractive than the resin bait used in this study.

Window traps collected both flying insects, *Hylastes* and *Pissodes*, but only one of the flightless *Steremnius*. Pitfall traps collected significantly ($P = 0.01$) more of all three insect species than the window traps (Table 1). All baits attracted insects, but in the window traps 1% resin attracted significantly ($P = 0.01$) more *Hylastes* than 100% resin or 95% ethanol. Few *Pissodes* and *Steremnius* were collected by window traps and there were no significant differences in numbers of these species attracted by the three baits. Pitfall traps are adequate to monitor these three insects and are much easier to maintain than window traps.

Although the presence of these insect species in black stain root disease centers is now confirmed, no isolations for *L. wageneri* were attempted to establish that these potential vectors were indeed vectoring the black stain root disease pathogen. Further studies are needed to address the relative importance of insect vectoring versus root contact as means for infecting regenerating Douglas-fir in black stain disease areas.

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